

Getting Better Outcomes from Weapon System Programs

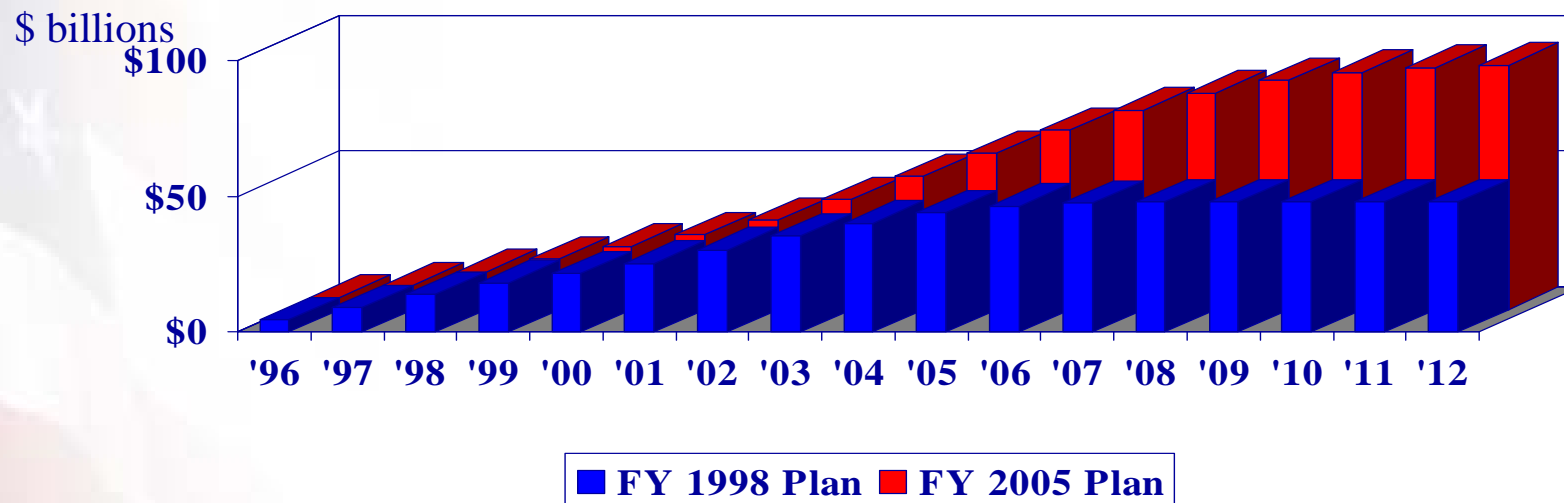
Acquisition and Sourcing Management U.S. Government Accountability Office

Matt Lea
Senior Defense Analyst
Dayton Field Office
937.258.7962
LeaM@gao.gov

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE MAY 2006		2. REPORT TYPE		3. DATES COVERED 00-00-2006 to 00-00-2006	
4. TITLE AND SUBTITLE Getting Better Outcomes from Weapon System Programs				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Government Accountability Office, 441 G St., NW, Washington, DC, 20548				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM002184. Presented at the Air Force Research Laboratory Seminar/Workshop on Multi-Dimensional Assessment of Technology Maturity in Fairborn, OH on 9-11 May 2006.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 20	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Placing Context On The Fiscal Environment

- Future demographics demand more from DOD's investment accounts
- Current practices yield systems at unexpectedly high cost, diminished results



FY '05: \$89.95 billion total

FY 1998 plan for completing development of 8 programs

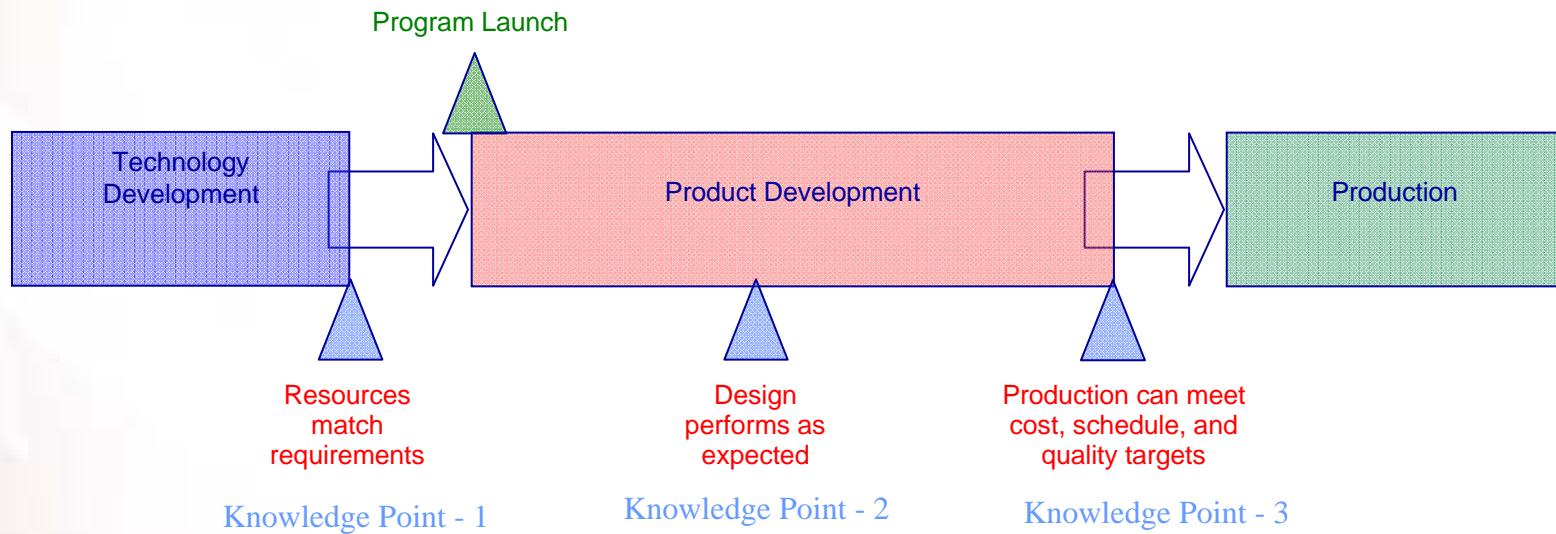


Additional investment needed under FY 2005 plan for completing the 8 programs

¹Source: Selected Acquisition Report data (12/31/96 and 12/31/03) on the 8 weapon systems among the highest R&D budget requests for FY 2003.

Note: All dollars are in constant FY 2005 dollars.

Delivering the Product



The Knowledge-Based Approach



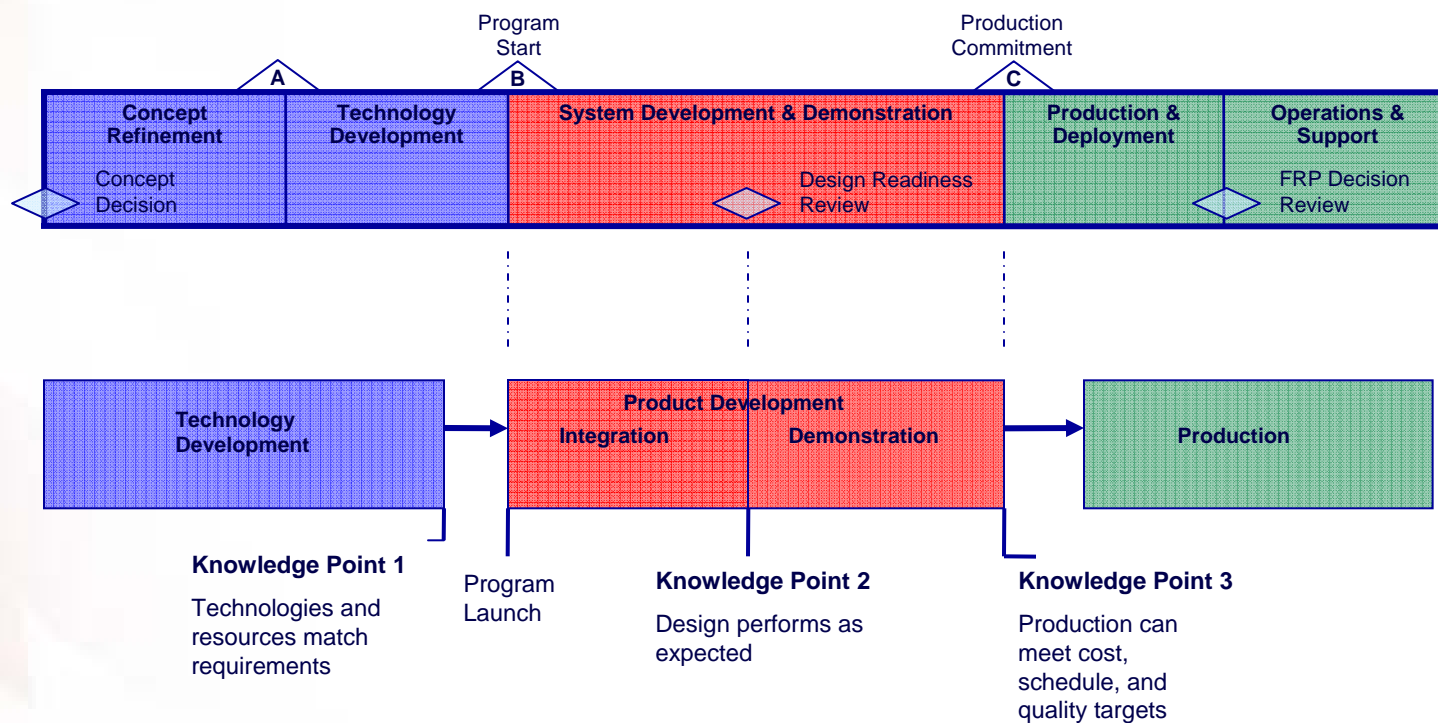
Technology development is done separately and in advance of product development; Milestone B is the dividing line.

Knowledge Point 1: At milestone B, a match is achieved between the user's needs and the developer's resources (**key indicator: technology readiness level**).

Knowledge Point 2: At Critical Design Review, the product design demonstrates its ability to meet user needs and is stable (**key indicator: % of engineering drawings released**).

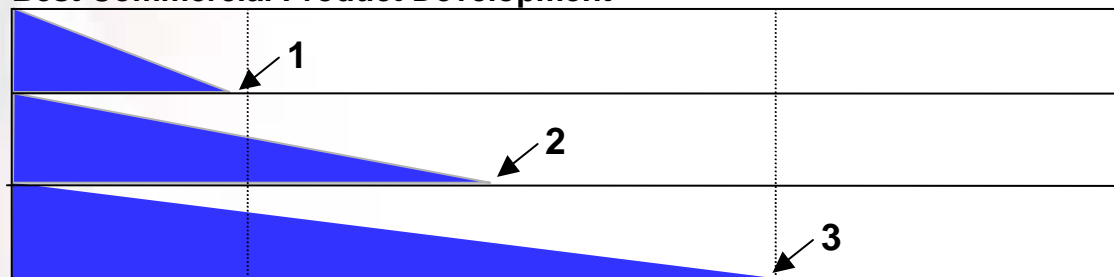
Knowledge Point 3: At milestone C, it is demonstrated that the product can be produced within cost, schedule, and quality targets (**key indicator: % of key processes in statistical control**).

DOD Process and Best Practices Model Has Similar Framework

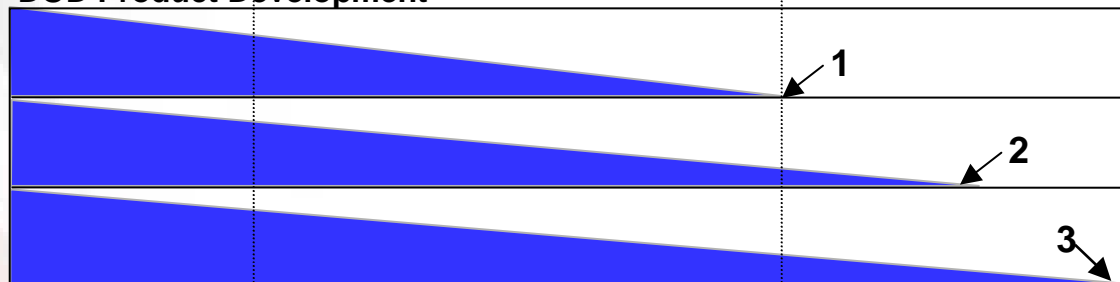


Knowledge at Key Junctures is Critical To Delivering Programs As Promised

Best Commercial Product Development

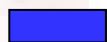


DOD Product Development

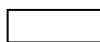


Program Launch

Production Start



Unknowns

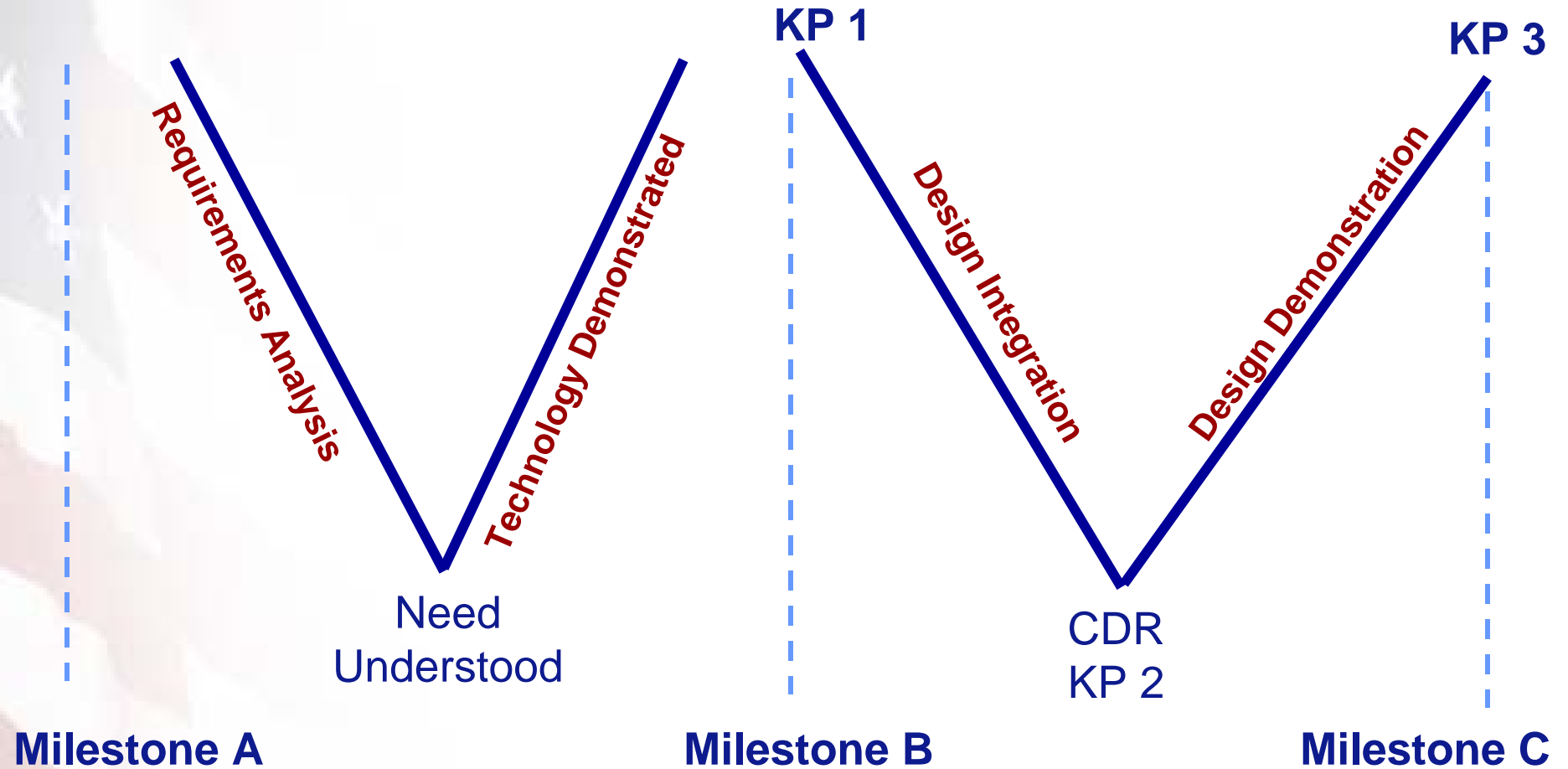


Knowns

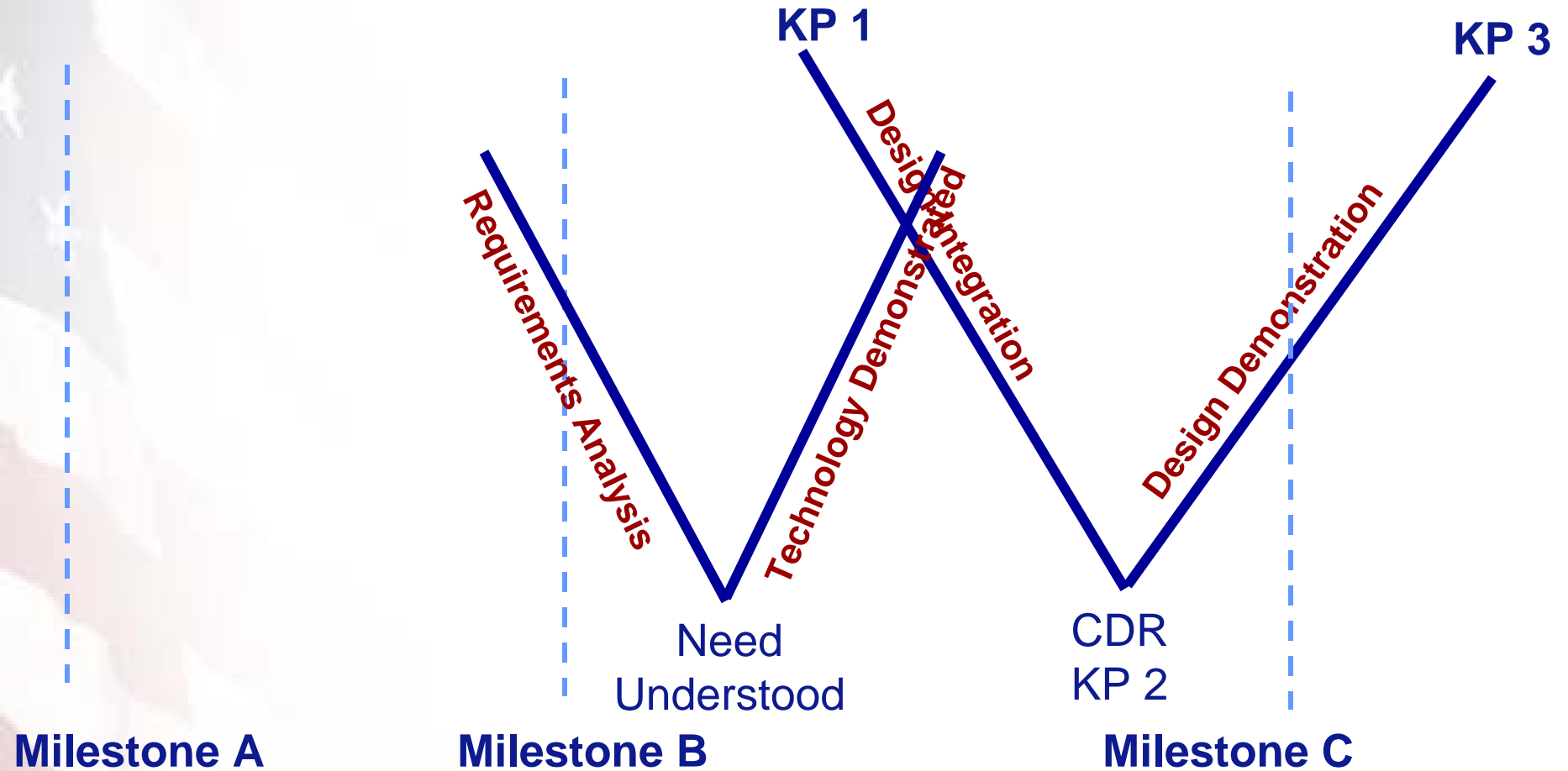
Knowledge Points:

- 1: Technology is mature enough to meet requirements (the match)**
- 2: Design is mature**
- 3: Production processes are mature**

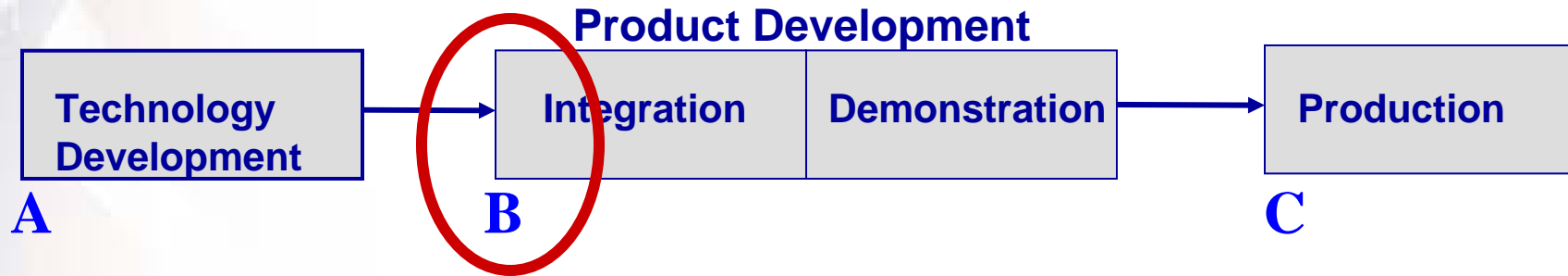
Knowledge Based Approach Aligns with Systems Engineering



Actual Acquisition Strategies Do Not Align with Systems Engineering



Knowledge Point 1: Match Developer Resources With User Needs



Milestone B Business Case Is Key

- If a program is unexecutable within resources at Milestone B, negative consequences are unavoidable
- Essential elements of a sound business case:
 - **A requirement exists that warrants a materiel solution consistent with national military strategy priorities**
 - **The materiel developer has the requisite mature technologies and technical knowledge necessary to meet the requirement**
 - **Systems engineering employed and preliminary design has been established**
 - **The materiel developer has a knowledge-based product development plan that will attain high levels of design and production maturity at the right times.**
 - **Reasonable estimates and funding is available to fully resource the product development and production plan**

Immature Technologies at Product Launch Have Weakened DOD Business Cases



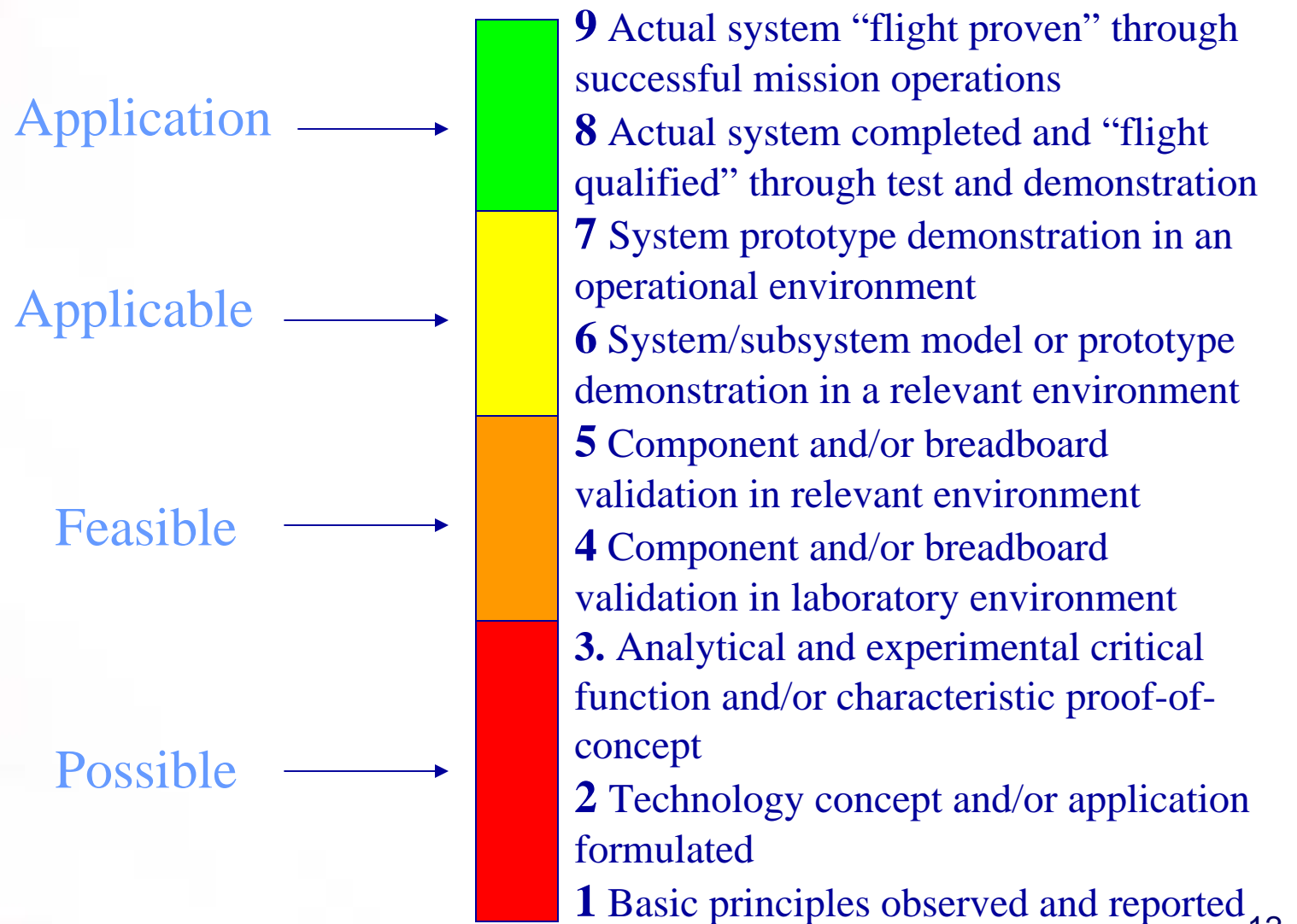
- Achieving high level of maturity critical indicator that business case is executable.
- Beginning product development with immature technologies longstanding DOD problem.
- Predictability is key, invention cannot be scheduled and costs difficult to predict.
- Cost of proceeding into system development without completing technology development can be dramatic.

Best Practices for Including Technology Onto Products

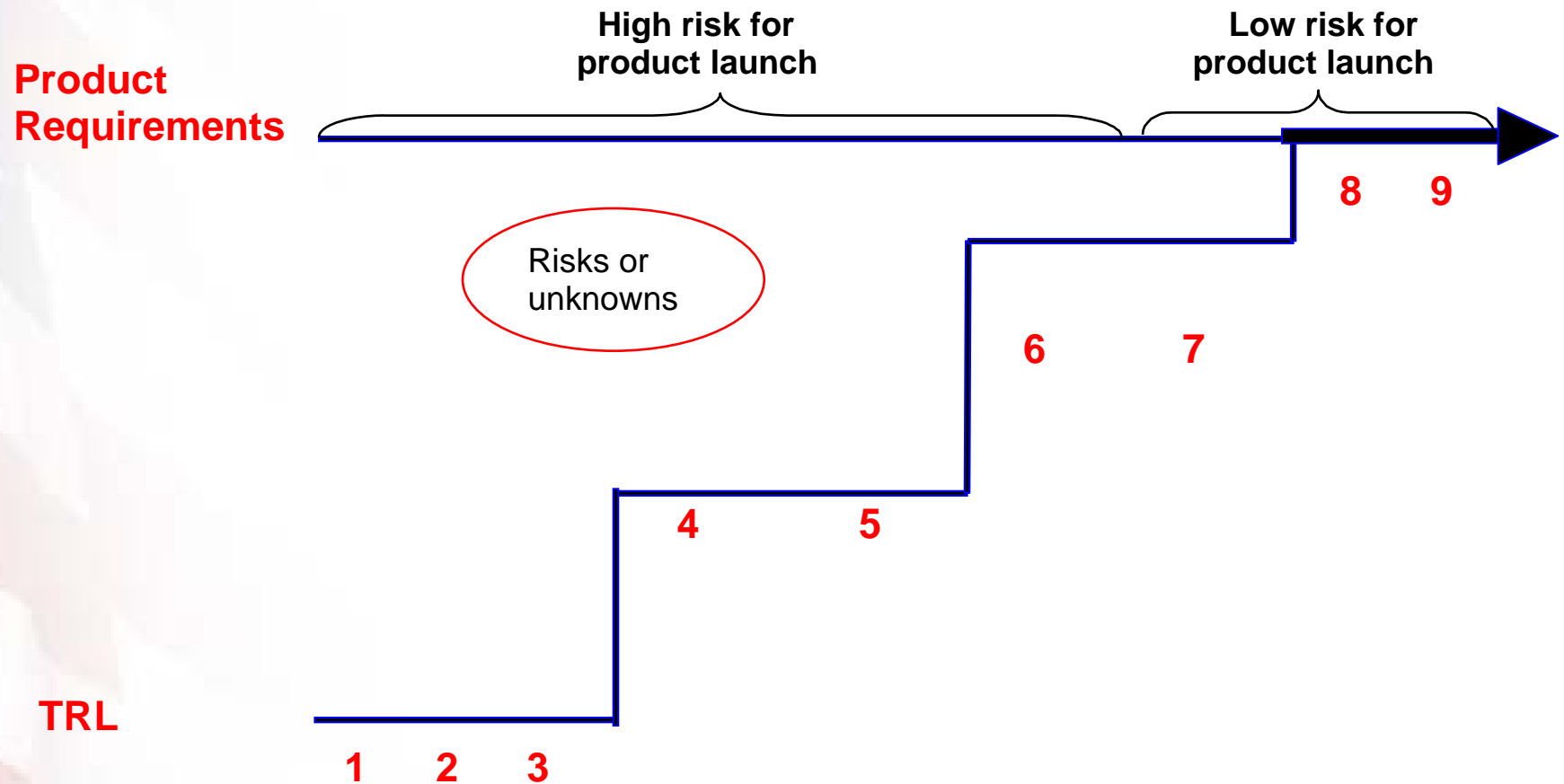


- Technology development separate from product development
- Responsibility for technology development to S&T organizations rather than product managers
- Development follows disciplined process
- Environment is critical for technical maturation
- Decision makers need tools and authority
- Technology not brought onto product unless demonstrated that it meets requirements.

Technology Readiness Levels For Intended Product



Using TRLs to Match Technology with Product Launch Requirements

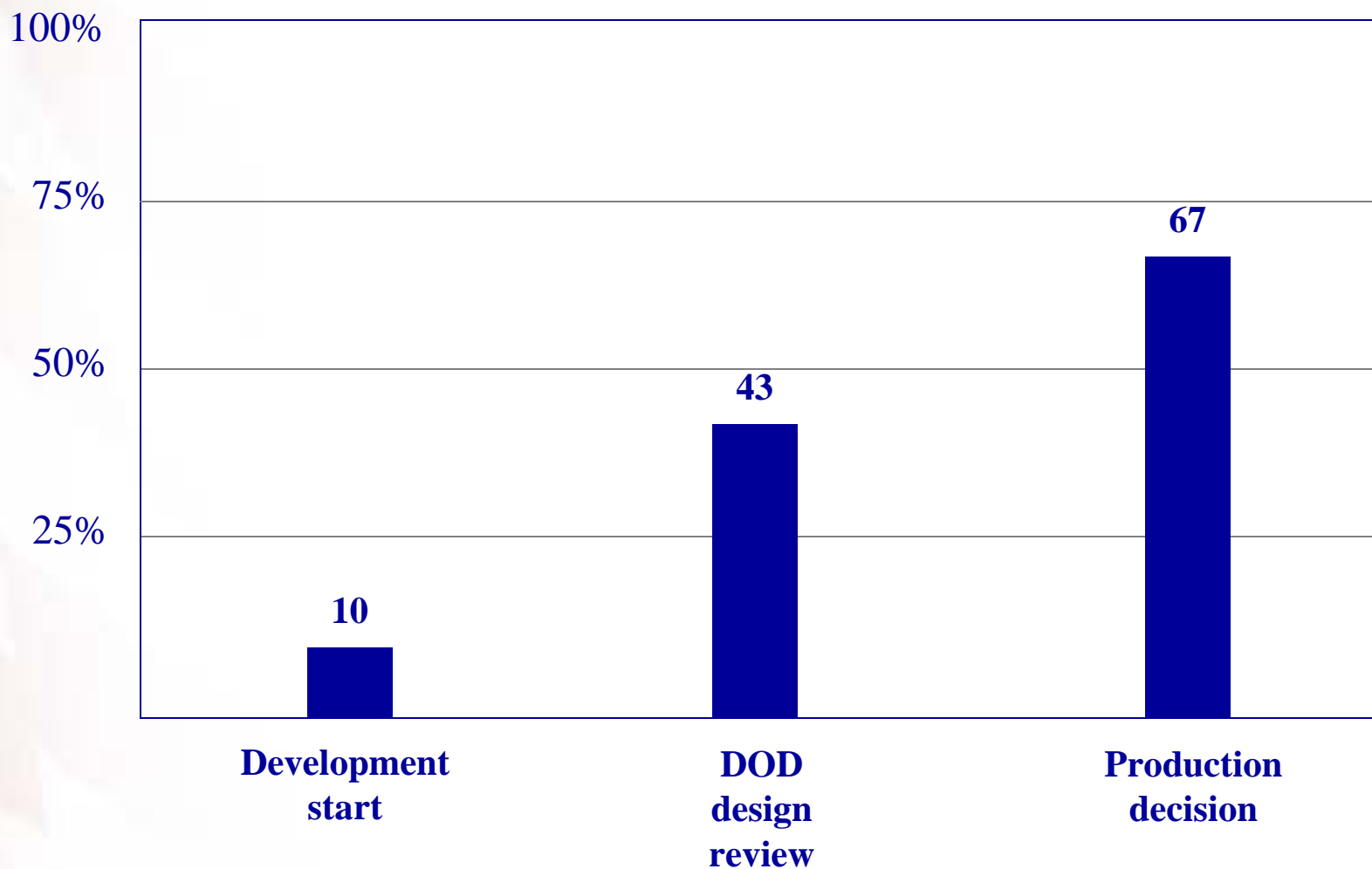


DOD Has Made Constructive Changes In Policy, But Implementation Remains A Challenge



- **DOD 5000 policy says most of the right things about separating technology development from system development**
 - Calls for technology maturity to TRL 6 (relevant environment)
 - Calls for evolutionary approach as a check on reqts.
 - Short development cycle times (5 years or less)
- **However,**
 - Best practice standard is TRL 7 (operational environment)
 - Most individual programs do not even abide by policy
 - Many programs fall outside: satellites, MDA, ships
 - Those within are unique: eg., FCS, JSF
 - Preference is still for revolutionary, not evolutionary
 - Knowledge gaps and optimistic estimates at MS B are the norm and are reinforced with approval and funding

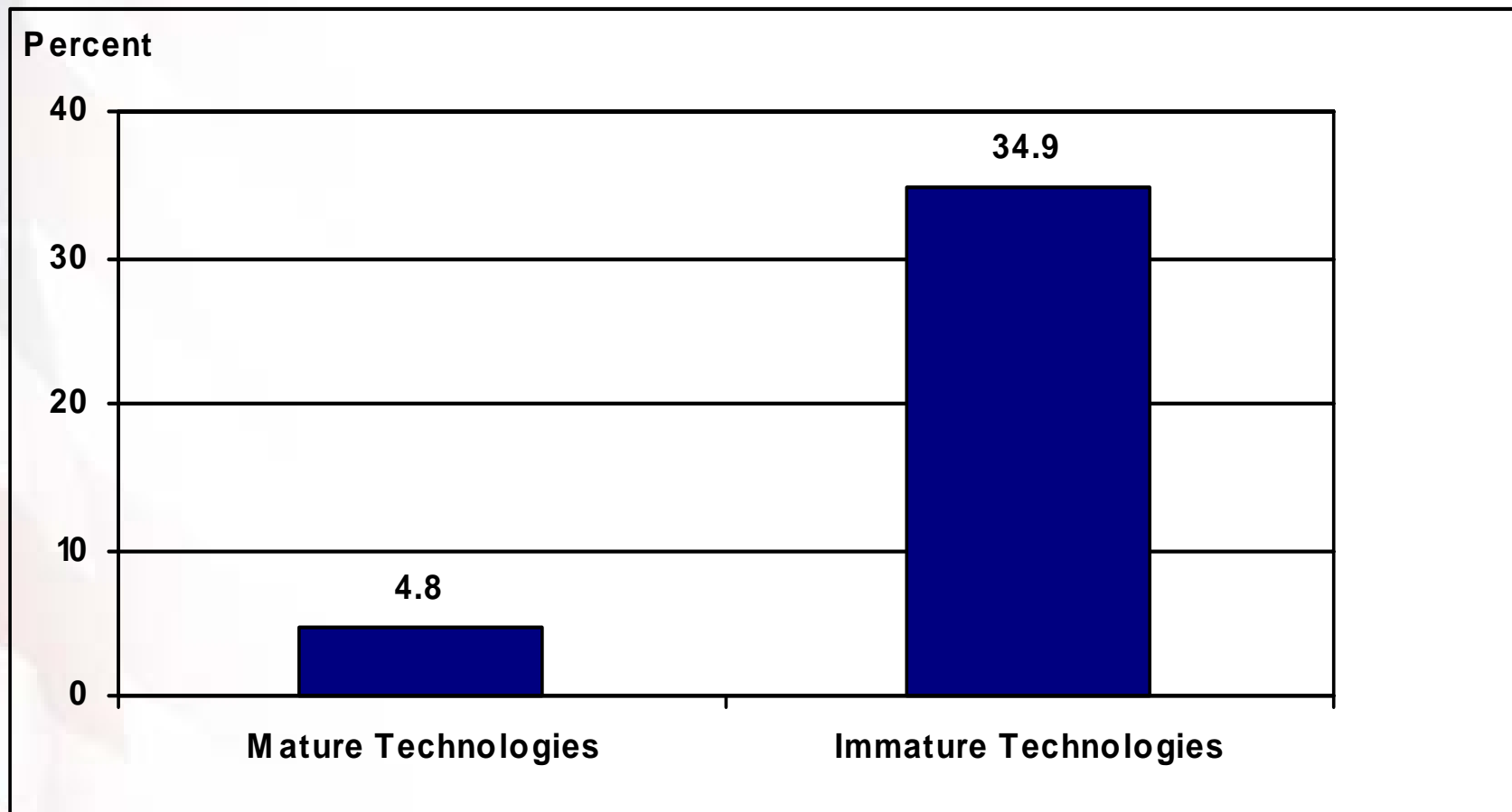
Percent of Programs that Achieved Technology Maturity at Key Junctures



Source: *Defense Acquisitions: Assessments of Selected Major Weapon Programs*. GAO-06-391. Washington, DC.: March 2006.

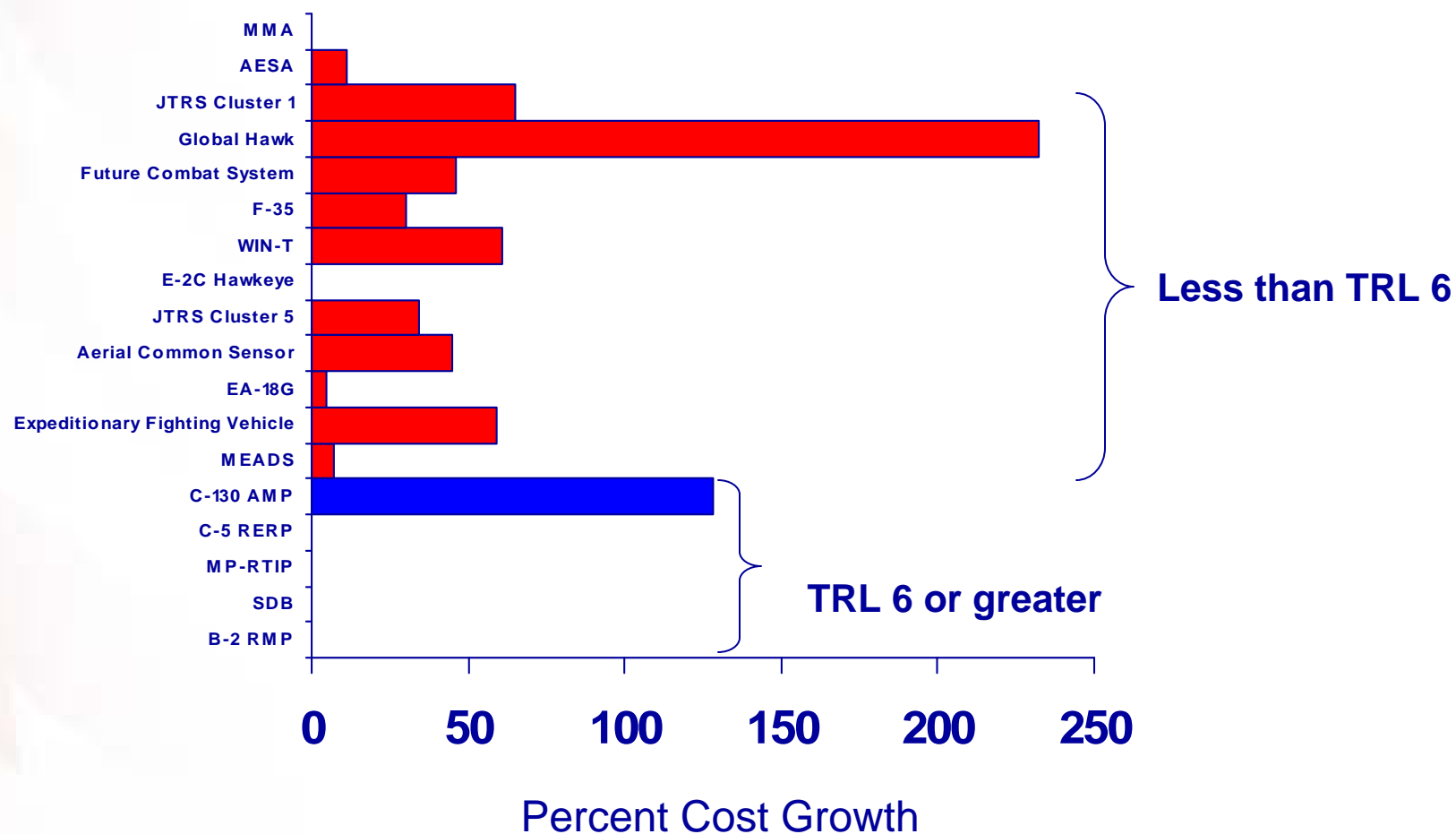
Immature Technologies Continue To Spill Over Into System Development

Average Program Research, Development, Test and Evaluation Cost Growth From First Full Estimate



Source: *Defense Acquisitions: Assessments of Selected Major Weapon Programs*.
GAO-06-391. Washington, DC.: March 2006.

Condition Continues Under Revised Policy



Source: Defense Acquisitions: Major Weapon Systems Continue to Experience Cost And Schedule Problems Under DOD's Revised Policy. GAO-06-368. Apr. 13, 2006

Challenges That Remain To Getting Better Outcomes



- How will initiatives like strengthened focus on SE, EMRLS, etc., succeed when incentives encourage starting programs too early, making revolutionary technical leaps, underestimating cost and risk, and promising record delivery times?
- Can we employ evolutionary acquisition and trade requirements to match a 5-year cycle and to mature technologies?
- Can we provide S&T the funds, organization, and authority to do the necessary pre-acquisition SE and technology development work?
- Can we put managers in a position to succeed with a shorter cycle and hold them accountable for results?
- Can capabilities-based requirements be controlled so that tradeoffs can be made?
- If the solution requires the invention of numerous technologies, is so complex that the government cannot be the integrator, and so expensive that it takes most of a service's budget, is it really a viable solution?

Encourage Best Practices By Changing Incentives



- ✓ Use knowledge-based approach for decision making
- ✓ Measure knowledge against high and clear standards
- ✓ Separate technology development from product development
- ✓ Realign technology responsibilities and funding
- ✓ Discipline requirements-setting process by demanding match
- ✓ Send signals through investments on individual programs

Reports Available at www.gao.gov

- **Best Practices: Better Support of Weapon System Program Managers Needed To Improve Outcomes.** GAO-06-110. Washington, D.C.: November 30, 2005
- **Defense Acquisitions: Stronger Management Practices Needed to Improve DOD's Software-Intensive Weapons Acquisitions.** GAO-04-393. March 1, 2004
- **Best Practices: Setting Requirements Differently Could Reduce Weapon Systems' Total Ownership Costs.** GAO-03-57. February 11, 2003.
- **Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes.** GAO-02-701. July 15, 2002.
- **Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes.** GAO-01-288. March 8, 2001.
- **Best Practices: A More Constructive Test Approach Is Key to Better Weapon System Outcomes.** GAO- NSIAD-00-199. July 31, 2000.
- **Best Practices: DOD Training Can Do More to Help Weapon System Program Implement Best Practices.** GAO/NSIAD-99-206. August 16, 1999.
- **Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes.** GAO/NSIAD-99-162. July 30, 1999.
- **Best Practices: DOD Can Help Suppliers Contribute More to Weapon System Programs.** GAO/NSIAD-98-87. March 17, 1998.
- **Best Practices: Successful Application to Weapon Acquisition Requires Changes in DOD's Environment.** GAO/NSIAD-98-56. February 24, 1998.
- **Best Practices: Commercial Quality Assurance Practices Offer Improvements for DOD.** GAO/NSIAD-96-162. August 26, 1996.